

DATE:

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H⁺ and F⁻ 2 grown up overnight 5 from single colonies as B-D₉
 7.5 ml + 1 ml H⁺ + 1 ml F⁻

10

w 3229 1/2 X w 3133

w 3229 1/2 X w 3127

w 3229 1/2 X w 2244

w 3140 1/2 X w 3133

w 3140 1/2 X w 3127

w 3140 1/2 X w 2244

w 3133

w 3127

w 2244

20

make mixtures 1-6 in duplicate (7.5 ml. necessary to 1 ml H⁺ + 1 ml F⁻)
 call duplicate X & Y. For Pat. in rotation.

A after 1 hr. add 1 loop T6 to ~~X~~ ^{Pat. in rotation.} after 4 hrs. dilute 10 X 10 X 10
 and plate 0.1 ml from each dilution tube on M gal and M lac.
 Count colonies at ~~24~~ 48 hrs.

30

B Dilute ~~X~~ X 10 and X 100 and plate 0.1 ml on M lac. Streak
 colonies on M lac. Replicate on B lac + T6 and S lac + T6.
^{1/5} ^{1/6} lac⁺ Streak out lac⁺ colonies
 B lac and isolate hybrid.
 S lac

40

C. after 12 hrs. plate from ~~X~~ to give 100 colonies per plate of
 S lac. (i.e. 1/6 PC-O). Incubate for 48 hrs. or more and pick lac⁺ stable colonies.
 Test for allelism with parents and pick lac⁺ x lac⁺.
 Recombination should be suppressed only between X and Y.
 lac⁺-1 x and lac⁺, y should give O NPG double mutant,
 lac⁺ x and other lac⁺ should give O NPG.

50

4 for M⁻ (P⁻) V₆⁺ loc⁻ x V₆^S loc⁻ prototype in primary

2 wro. add T6

4 hrs. Plate serial dil. on M loc and M gal.

$$\theta = \frac{\text{M loc count}}{\text{mgal count D-O}}$$

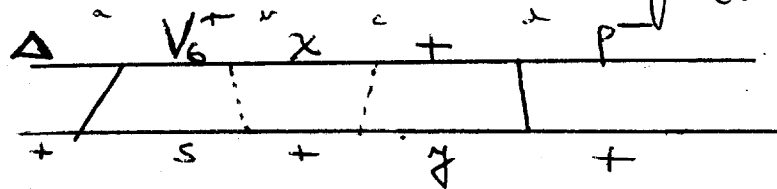
$$\theta = \frac{a b c d}{n}$$

Cross 1

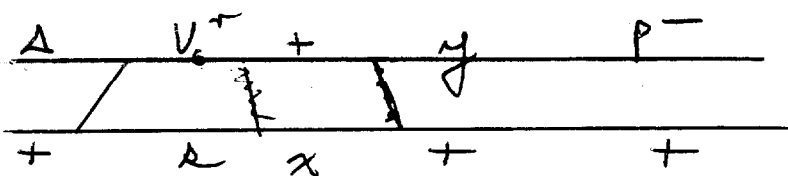
M loc

D-O

D-O of prod



Reciprocal cross



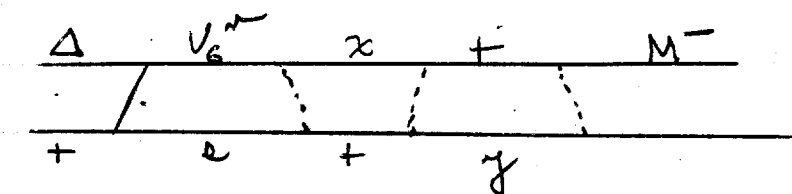
$$\theta = \frac{a c}{n}$$

Pt

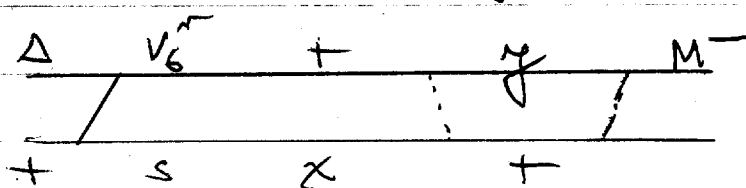
on M loc

D-O

~~D-O of prod~~



$$\frac{bc}{n}$$



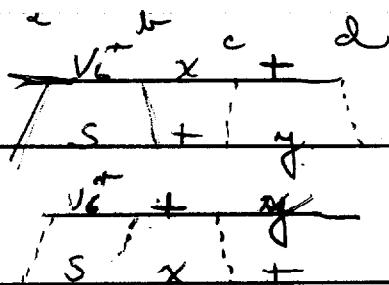
$$\frac{c}{n}$$

Transduction:

+T6

$$\theta = \frac{\text{M loc count}}{\text{mgal count}} = \frac{\text{above}}{\text{(below)}}$$

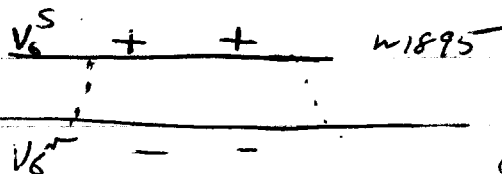
$$\frac{ac}{n(b+c+d)}$$



loc⁺ int⁺ V₆^S

F⁻ x⁺

w 3159



w 1895

Strain from M loc

M loc int⁺ loc + T6

Strain V₆^S colonies onto
plate + T6 and replicate
on Blue + T6.

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D. ✓ Transduce $lac^- \times V_6^+ F^-$ prototroph with lysate from
 $Hf^+ M^+ P^- lac^+ V_6^+$ on M lac. Streak colonies on M lac
 and replicate on B lac + T6 and S lac + T6. Streak out new
 colonies and isolate heterozygote.

10

P lac



S lac

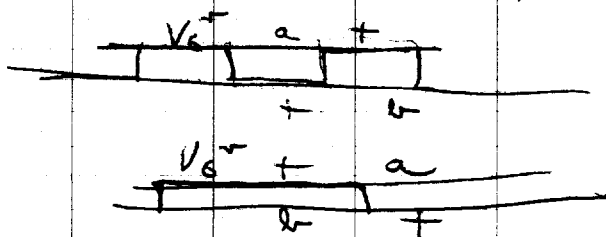
"

"



E. Transduce $lac^- \times V_6^+ F^-$ prototroph with lysate from
 $Hf^+ M^+ P^- lac^+ V_6^+$ ~~on M lac~~ in broth. after 1 hr. add T6.
 after 4 hr. plates on M lac and M gal from serial dilution tubes.
 Count colonies M lac V_6^+ transduction, lac^+ transduction, C.O.

20



30

F. Plate from E on B lac ^{to give 100 colonies per plate.} incubate for 24 hr. and pick lac^+ st.
 Test for allelism with parents and pick $lac^+ lac^+$.

40

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A matings X and Y in refrigerator overnight. Plate X and 4X on M⁺ and M⁻ lac.

1 0.1 ml

2 X 1/11

3 X 1/11

0.1 ml.

A-1, 3, 5, 6, 7, 8, 9

B. 1/2, 3 and 4, 5 on M⁺ lac.

20 12/2/56. Incomplete lysis of 1/6^S in A, as shown by plaques in streaks on B lac.

count

1-1 0

1-3 0

2-1 TMC

2-3 ca. 200

3-1 TMC

3-3 ca. 200

4-1 ca. 300

5-1 ca. 68

6-1 0

7-1 0

8-1 70

9-1 0

growth of plate resembles to on M⁺ lac.
count at 24 hrs.

∴ w3127 allelic to w3140, but with greater mutation rate see M⁺.

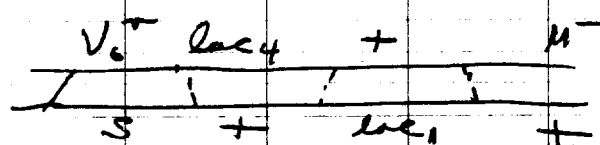
Try 26 Va w3127 to obtain lac^{stable} 2-step mutant.
Can be used with w3150 to obtain 2-step mutant by recombination.

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	1	2	3	4	5	6	7	8	9	10
	A	Count Mlac	Mmal							
	1-1	0								
	2-1	TMC	TMC							
	2-2	ca. 2000	TMC							
10	2-3	ca. 500	TMC							
	2-4	55	14 (dry plate)							
	2-5	3	134							
	2-6	0	33							
	2-7	0	0							
20	3-1	TMC	—							
	4-1	ca. 300	TMC	← ca. 200 plaque.						
	4-2	42	TMC)						
	4-3	4	TMC)						
	4-4	0	TMC)						
30	4-5	0	ca. 600							
	4-6	0	335							

∴ suggested order is



5-1 85 —

B. Streak directly from B 2-3, B 3-3, and B 4-1 on Mlac.
12/5. Pour for replication on B lac & M lac + T6.

Better to streak from recombinant plate onto B lac, isolate
het., and pick single lac⁺ colonies to streak against
T6 on B-O, B lac, or M lac (one plate of each). Pick single
colonies into 1 ml. per assay; streak for this against T6.

Several possible lac₁/4 heterozygotes streaked out against
on B lac from 3140 x 3133 (B4). Single colonies picked
het. detected o.k. (over)

Two lac^{st} , two lac^m picked. Streaked on M and B lac .

all four colonies prototrophs. Streaked on B-0 against T6.

lac^{st}		D
lac^{st}		D
lac^m		D
lac^m		D
	T6	

all four colonies
w/3133
 lac .

Cross Streaked on M lac

	3229	3140	3271
lac^{st}	○	○	6
lac^{st}	○	○	○
lac^m	○	○	○
lac^m	○	○	○

N44

Search for heterozygotes with loc^{Y53}₁

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12/3/56

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N13

	1	2	3	4	5	6	7	8	9	10
	loc ₁ (het?) TLB ₁ from ^{W3236} _{W3286} X Hfr V ₆ ⁺ loc ⁻ M ⁻					0.1 ml. of each parent				
	in DM + 1% lac. Streak on B lac.									
10	1941	no lac ⁺								
	3221	"								
	3143	"								
	3229	"								
	1949	"								
20	1946	"								
	1947	"	Try again							
	2243	"								
	3140	"								
	3240									
30	3237									
	3266	✓	het streak out							
	1945	no lac ⁺								
	3146	"								
	1942	"								
40	1943	"								
	3239	"								
	3164		streak out							
	2245	no lac ⁺								
	3238	"								
50	3268	streak out								
	3267	no lac ⁺								
	1940	"								
	1944	"	but see ^{other} plate. Streak out.							

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9 AM. 2 ml. $\angle \phi$.6% agar + 0.1 ml. Hfr V_6^{+} + 0.1 ml. Phe (10⁷)
Pour on $\angle \phi$ plate (ca. 45 ml./plate).

4 PM. Add 4 ml $\angle \phi$ broth.

8 PM. Recant. add chloroform. Enteric box.
w3229 shows discrete clear plaques

12/5/56 C- $\angle \phi$.

(P)

w3236

w3236P₁⁺

□

46-1

1940

S

~

○

1941

S

~

⊕

3229

S

~

○

20

1485

S

~

○

3146

wh. lysia

~

+

add more Chloroform.

1946

S

~

○

46-2

1147

S

~

○

3164

S

~

○

30

3271

S

~

○

3240

S

~

○

46-3

3159

S

~

○

343

S

~

○

40

3237

S

~

○

1943

S

~

○

1945

holysis

~

○

from B-0 pour plate.

50

Test on V_6^+ and F^-X^+ derivatives of new lac stocks

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REF:

	1	2	3	4	5	6	7	8	9	10
47-1 nutrition.	Spot on Bgal plate for replication to Small, B lac, Bglucase.									
	3237		3270		3112					
	3240		3271		2243	wh. to +				
10	3266		3272		2244					
	3267		39-1	wh.	2245	wh.				
	3268	wh.	39-2		3238					
	3269		39-3		3239					
47-2 V_6^+ stocks streaked against T6.										
20	3164	~	39-1	(only a few colonies visible)	3239	~	1941	~	1942	~ 3266w
	2243	~	39-2	~	3120	~	1945	~	1943	~ 3268w
	3140	~	393	~	3113	~	1948	~	1944	~ 3269w
	2245	~	3272	~	1950	~	1949	~	1947	~ 3270w
	3238	~	3236	~	1951	~	3146	~	3237	~ 3271w
30	3239	~	1940	~	3221	~	1946	~	3240	~
	3229 V_6^+	3269 V_6^+	3270 V_6^+	3271 V_6^+	3272 V_6^+					alcohol tests of $V_6^+ X^-$
	3112	++	(0)	(0)	(3)	++		1940	✓	
	2243	+++	+++	+++	+++	+++	reversion	1942	✓	
	2244	+++	0	0	0	+++		1943	+++	} F^- reversion
	3147	40	0	0	0	++		1944	*++	
	3149	++	0	0	0	++		1947	✓	
	3215	++	0	0	0	++		1945	✓	
	3151	++	0	0	0	++		1948	✓	
	154	++	0	0	0	++		1949	✓	
	3238	++	0	0	0	++		2245 alt	✓	
	3239	~	~	~	~	~		1950	recombination	
	2245	++	++	++	++	++		3146	dissect the cultures	
								1951	✓	3270 ✓
								1946 alt	✓	3272 ✓
								323 ?	3269 ✓	

nutritive test

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	47-1 replicated on 3 several sugars					6	7	8	9	10
	Bgal	Ble	Bmal	Bnth	Ble.	Bova				
3237	+	-	+	+	+	+				
3240	+	-	+	+	+	+				
3266	+	-	+	+	+	+				
3267	+	+	+	+	+	+				
3268 ¹⁰	-	-	-	-	-	-	very little growth			
3269	+	-	+	+	+	+				
3270	+	-	+	+	+	+				
3271	+	-	+	+	+	+				
3272	+	-	+	+	+	+				
3273 ¹⁰	-	v. wh.	-	-	-	-	like 2243 in pattern			
39-2	+	-	+	+	+	+				
39-3	+	v. wh.	-	+	+	+				
3112	+	-	+	+	+	+				
2243	+	+	+	+	+	+	reverted			
2244 ¹⁰	+	-	+	+	+	+				
2245	-	-	-	-	+	+				
3238	+	-	+	+	+	+				
3239	+	-	+	+	+	+	(only few colonies indicated)			
allelic test on m. lac.										
Hfr V6	Y10	allelic F ⁻ w3133	allelic F ⁻ w3133	allelic F ⁻ w3133	Hfr V6	Y10	allelic F ⁻ w3133	allelic F ⁻ w3133	allelic F ⁻ w3133	allelic F ⁻ w3133
3229	++	0	0	0	3159	7	7	7	7	7
3120	++	14	0	0	1945	++	3	1	0	0
3H3	+	6	0	0	1948	++	0	0	0	0
950	++	++	++	++	1949	++	13	0	0	0
1510	++	50	3	3	3146	++	0	0	0	0
3221	++	20	?	?	1946	++	0	0	0	0
1941	++	3	0	0	3269	++	0	0	0	0
					3270	++	0	0	0	0
					3271	++	0	0	0	0
					3272	++	0	0	0	0

10/12/56

REF:

[illegible]

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	1	2	3	4	5	6	7	8	9	10
	0.1 ml	3120/6	0.1 ml. F-X ⁺ in 7.5 ml. primary.							
										cell from week-old broths.
										Cross & streak on M lac + T6.
1	3230		24			5				
2	3089		20 (dry plate)							
3	3148		50			31				
4	3152		100			36				
5	3174	3153	300			42				
6	3156		100			38				
7	3175		300			45				
8	3146 F-		300			15				
9	2244		30 (dry plate)			11				

12/14. 0.1 ml. - 9 in 10 ml. H₂O; plate 0.1 ml on M lac.

Plate 0.1 ml. from 3/35, 3089, etc. To half-plate add 1 drop

20 P1 (W320 V6).

+ P1 central

10. also 1 drop on Blue.

(12)

11	W3133	0	0
12	W3089	0	0
13	W3148	0	0
14	3152	28	14
15	3156	30	10
16	3175	22	0
17	3146 F-X ⁺ 40	10	
18	2244 on M mal		
19	3153 on M mal		

repeat

W3229 W3269 W3270 W3271 W3272 W3229 W3269 W3270 W3271 W3272

12/14/56. Repeat with fresh 24 hr. broths from B-4 single colony. (see N48A).

W3112
W3244
W3229
W3239
39 - F-X⁺

W3206 V6 X W3206 FT
21 22 23 24 25
26 27 28 29 30
31 32 33 34 35
36 37 38 39 40
41 42 43 44 45
46 47 48 49 50
51 52 53 54 55
56 57 58 59 60
61 62 63 64 65
66 67 68 69 70
71 72 73 74 75
76 77 78 79 80
81 82 83 84 85
86 87 88 89 90
91 92 93 94 95
96 97 98 99 100

25
V6 P₁ P₂ P₃ P₄ P₅ P₆ P₇ P₈ P₉ P₁₀ P₁₁ P₁₂ P₁₃ P₁₄ P₁₅ P₁₆ P₁₇ P₁₈ P₁₉ P₂₀ P₂₁ P₂₂ P₂₃ P₂₄ P₂₅ P₂₆ P₂₇ P₂₈ P₂₉ P₃₀ P₃₁ P₃₂ P₃₃ P₃₄ P₃₅ P₃₆ P₃₇ P₃₈ P₃₉ P₄₀ P₄₁ P₄₂ P₄₃ P₄₄ P₄₅ P₄₆ P₄₇ P₄₈ P₄₉ P₅₀ P₅₁ P₅₂ P₅₃ P₅₄ P₅₅ P₅₆ P₅₇ P₅₈ P₅₉ P₆₀ P₆₁ P₆₂ P₆₃ P₆₄ P₆₅ P₆₆ P₆₇ P₆₈ P₆₉ P₇₀ P₇₁ P₇₂ P₇₃ P₇₄ P₇₅ P₇₆ P₇₇ P₇₈ P₇₉ P₈₀ P₈₁ P₈₂ P₈₃ P₈₄ P₈₅ P₈₆ P₈₇ P₈₈ P₈₉ P₉₀ P₉₁ P₉₂ P₉₃ P₉₄ P₉₅ P₉₆ P₉₇ P₉₈ P₉₉ P₁₀₀

11

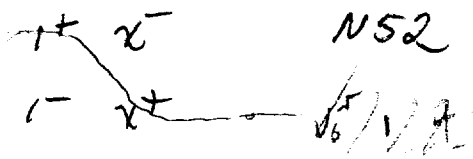
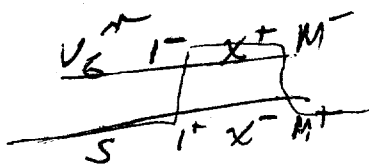
N49

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Hfr	w3269	3270	3271	F-8+ 3272	2244 3272	6	V ₆	49-89	3133	Y90
w3229	0	0	0	0	1		3237		++	++
w3221	(+)	+ <i>reversion?</i>	+	+	+		3240		0	++
① 1941	0	0	0	0	+		3266		+	++
1945	0	0	0	0	+		3267 ^{1/3}		++	++
1949 ¹⁰	0	0	0	0	+		39-1		++	+
3146	0	0	0	0	+		39-2		++	+
1946	0	0	0	0	++		39-3		+	+
② 3164	3	1	4	5	1		3268 1/3		++	+
39-1	++	++	++	++	++					
39-220	0	0	0	+	0					
39-3	0	0	0	+	+					
1940	++	++	++	++	++					
③ 1942	0	0	0	+	0					
1943	0	0	0	+	0					
1944 ³⁰	0	0	0	+	0					
1947	0	0	0	+	0					
3237	++	++	++	++	++					
④ 3240	0	0	0	0	0					
3266	0	0	0	0	0					
3268 ⁴⁰	++	++	++	++	++					
⑤ 3112	0	0	0	+	+	w3268V ₆		N49-7, N49-8		
2244	0	0	0	+	+	w3269				
3238	0	0	0	+	+	w3269				
3239	0	0	0	+	+	w3269				
39-1F	++	++	++	++	++	w3269				
Y10	++	++	++	++	++	w3269				
3149	0	0	0	+	+	w3269				
3215	0	0	0	+	+	w3269				
3151	0	0	0	+	+	w3269				
3154	0	0	0	+	+	w3269				
3237F	0	0	0	+	+	w3269				



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	1	2	3	4	5	6	7	8	9	10
1	M lac	Y105		W3229V6	1942					
		W3133		++	++					
		31A		++	++					
	0.1ml. / 10ml. H ₂ O.									
10	Hfr	F ⁺ X ⁺		5	~					
2	W3229V6	W3215	30	5	0	23	W3146	W2244	50	15
3		W3151	14	6	0	24		W3147	200	27
4		W3154	100	57	0	25		P1(W3229V6)	W3147	5(W3147), 4(Hfr)
5		W3112	100	72	0	26		W2244	0(W2244), 80(Hfr)	82
6		W3238	200	[40	8]?	27		W3089	2(W3089), 24(Hfr)	18
	1946V6									
7		W3134	200	52	11	✓				
8		3089	150	40	9	✓				
9		3148	150	57	4	✓				
10		3152	70	50	8	✓				
11		3156	150	42	10	✓				
12		3146F ⁻	200	-1	7	✓				
13		W3153	27	30	0					
14		W2244	5	6	4					
15		W3147	200	38	17					
	W3146									
16		W3134	200	52	11	✓				
17		W3089	70	40	9	✓				
18		W3148	100	57	4	✓				
19		3152	20	50	8	✓				
20		3156	70	42	10	✓				
21		3146F ⁻	0	-1	7	✓				
22		3153	30	30	0					

Second report on lac- study

N. Morton
Jan. 10, 1957

New stocks. Five new lac- stocks have been prepared by UV-induced mutation in W3236 and called W3267,8; N39-1,2,3. V_6^r stocks were derived from each of the Hfr lac- stocks by selection in broth. In future, a V_6^r stock will be used as source of new lac- mutants to assure identity of the V_6^r marker.

Lac- stable derivatives of the two allelic mutable stocks W3120 and W1950 were obtained after UV treatment (N36). Of 10 non-papillate colonies of each type tested, 2 of each stock failed to recombine with other lac-1 mutants. These colonies were labeled W3269-72.

Mapping of V_6 , lac, P. A cross was made between W1366 V_6^r lac^{w112}₁ (V_6^r (TLB₁)⁻ F- and W3236 Hfr-1 P- M- on D-O+proline. The scoring of 218 recombinants gives as the most likely order

(Hfr) V_6 lac P V_1 (TLB)
 35 15 22 31 38

In several other experiments ^{there} was some selection for P+, but the same order and approximately the same distances are indicated.

ONPG tests

Single colony isolates from B-O were grown overnight on a rotator in YZ broth + 0.5% lactose +0.5% glycerol. These cultures were spun down, the pellet resuspended in 1 ml. water, and the cells autolysed by shaking with 1-2 drops of benzene. To 0.1 ml. of this mixture were added 2 ml. of an ONPG solution (30mg./400ml.) and the color read by eye after 10 minutes at 37° C. All of the single-step lac-1 mutants were ONPG+. Of the two-step lac-1 mutants, W3159 and Y70 were also +, but W3229 and W3269-72 were ONPG-. All of the remaining lac mutants were ONPG- except W3267, which contained reversions, W3268, which is a weak fermenter of several sugars, and W3239, a lac- stock received from Borek. Lac-3, lac-5, and N39-1,2,3 were not tested.

Aliquots of all stocks were tested for lac⁺ reversions before autolysis; only W1950 and W3267 contained a detectible number of reversions.

Fermentation tests

W3268, N39-1, and lac-3 ferment galactose, maltose, glucose, and arabinose weakly or not at all. N39-3 does not ferment maltose, but does ferment the other sugars. Lac-5 does not ferment galactose or maltose but does ferment glucose and arabinose. The remaining lac- mutants will ferment all the other sugars tested.

Crossover suppression in two-step mutants

Of the 2 ONPG + two-step lac-1 mutants, Y70 shows the ^{same} recombination pattern as Y53, and W3159 covers all of the recognized lac-1 region except W1946. W3229 and W3272 cover all of the lac-1 region and presumably extend beyond it, since they are ONPG-. However, they have not been shown to be allelic with any ONPG- single-step mutant. W3269-71 do not recombine with lac-2 and lac-4 or with the majority of lac- mutants of unknown location. Either the region of crossover suppression is large, or most of the lac- mutants are in the neighborhood of lac-1.

Transduction tests

If an M lac plate is spread with two drops of an F- lac- prototroph and half of the plate respread with 1 drop of a P1 lysate obtained from a non-allelic lac- Hfr V_6^r by the Lennox modification of the Adams layer plate technique, then a yield of from 20 to 300 colonies will be obtained with P1 at a time when the control half of the plate is blank or has at most a few colonies. Allelic lysates give zero yields. In all combinations so far tried, the proportion of V_6^r among lac⁺ colonies is less than 1%. No persistent heterogenotes have been obtained.

Recombination tests

More than 20 crosses have been made of Hfr V_6^r M- lac- x F- lac- prototroph

on M lac, the colonies being cross-streaked, without purification, against T6 on M lac. The Hfr parents have been W3229, W1946, W3146, and W3120. In every case, the proportion of V_6^R among the recombinants is less than 50%, with no evident reversal of ratios in reciprocal matings.

Discussion

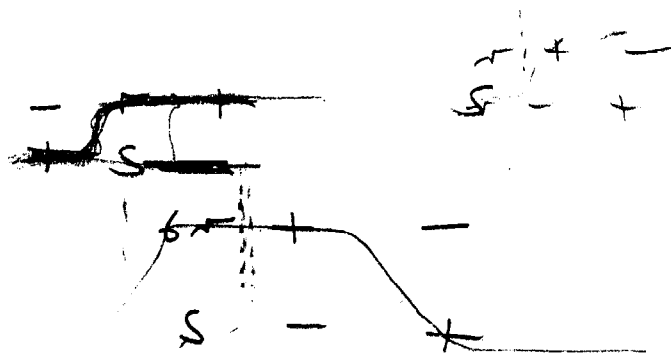
So far attempts to map the lac-1 region have been unsuccessful. This may be due to multiple adjacent crossovers in pairing regions, to proximity of the Hfr-1 elimination region to V_6^R , or to heterogeneity in the location of V_6^R mutants. It is not clear what the most expeditious way to investigate these possibilities will be. Tentatively it is proposed to use W3133 as a universal receptor for all P1 lysates and as a universal F- for all Hfr-1 stocks, excluding lac-1 lysates and stocks. This procedure is suggested by the fact that W3229 V_6^R gave no V_6^R recombinants with W3215, W3151, W3154, and W3112, indicating perhaps that there is a V6 locus closely adjacent to the crossover suppression region of W3229 and W3133. If at least one cross gives an excess of V_6^R , this will give some hope that the region can be mapped with existing stocks. If there is no such cross, the most hopeful possibility would seem to be that the Hfr-1 locus is responsible for the mapping difficulty, and either transduction with F- donors and receptors, another fertility system, or the use of P as an unselected marker may be tried. To introduce P or another Hfr into existing P+ stocks would be difficult.

DATE:

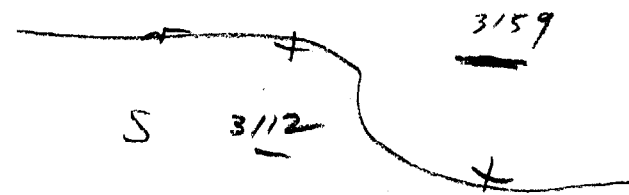
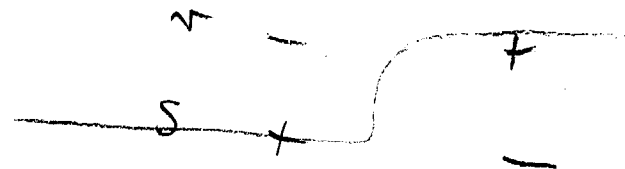
11/10/57

REF:

1. Drop W333 on 12 locs prepared half plate with 6 PI lysate, other half with drop broth. 10									
2. 0.1 ml W3133 on 10 ml 1/2 O. 0.1 ml Hfr V6 on 10 ml 1/2 O. Plate 1 drop of each on 12 locs. Cross-streak last recombination against - (in 12 locs.)									
Hfr V6									
W3164 (no dil.) ①	11	9	②	0					
W3140 (no dil.) ②	24	0	③	0					
W2245 (no dil.) ③ <i>all loc on streaking.</i>			④	0					
W3238 (no dil.) ④ <i>-MC all loc on streaking.</i>			⑤						
W1940 ⑤	12	2	⑥	200		24	0		
W1942 ⑥	5	5	⑦	200		23	1		
W1943 ⑦	14	9	⑧	200		24	0		
W1944 ²⁰ ⑧	15	1	⑨	±					
W1947 ⑨	18	2	⑩	200		24	1		
W3237 ⑩	3	9	⑪	200		28	0		
W3240 (no dil.) ⑪	0		⑫	200		14	0		
W3266 ⑫	18	3	⑬	0					
W3268 ³⁰ ⑬	3	26	⑭	200	✓	7	0		
N39-1 ⑭	6	15	⑮	200	✓	16	7		
N39-2 ⑮	19	2	⑯	0					
N39-3 ⑯	6	15	⑰	0	✓				
W1946 (control) ⑰	0		⑱	0					
W312046 (control) ⑱	0		⑲	0					
W3236 (control) ⑲	not done		⑳	0					
Recombination					Transduction				
W3159 ^{1/5} — x W3147			㉑	1	+				
W3149			㉒	1					
W3215			㉓						
W3151			㉔	0					
W3154			㉕	200	200				



$-1 \quad 2 \quad +$
 $+ \quad S \quad -$



DATE: 1/10/57

REF:

	1	2	3	4	5 ^{colony} control	6 ^{control} + PI	7 V ₆ ^S	8 V ₆ ^m	9	10
W3159 V ₆ ^r		X W3112		(42)	5	19	5	12	←	
		W3127		(45)	1	1				
		W3237F-X ⁺		(46)						
		N39-1F-X ⁺		(47)	0	0				
10		W2244		(48)	0	0				
		W2243		(49)						
		W2245		(50)						
		W3239		(51)						
		W3238		(52)	2.75	2.75				
W1306 V ₆ ^r		X W3147		(53)	15	45	38	3		
		X W3149		(54)	1	50	41	15		
		X W3215		(55)	1	50	30	5		
		X W3151		(56)	2	17	13	0		
		X W3154		(57)	1.75	1.75				
30		X W3112		(58)	5	58	47	6		
		X W3127		(59)	1.75	1.75				
Hfr V ₆ ^r		colony V ₆ ^S		V ₆ ^r	colony					
W3229 V ₆ ^r		W3147		53	27	0				
(61)		W3149								
(62)		W3215								
(63)		W3151								
(64)		W3154								
(65)		W3112								
(66)		W3127								
(67)		W3238								
(68)		N39-1F-X ⁺								
(69)		W2244								

DATE:

1/23/57

V6⁺ and lac unselected
on D-O, M-lac⁺:

	1	2	3	4	5	6	7	8	9	10
1.	W3236 V6 ⁺		Δ	r	lact	P-				
	Y70			S	-	+				
2.	W3236		Δ	S	+	-				
✓	W1366 V6			r	-	+				
10										
3.	W3229 V6		Δ	r	-	+		M-		
✓	Y10			S	+	+		TL-		
4.	W3229		Δ	S	-	+				
W2035	F- V6 ⁺ TL			r	+	+				
20										

predict V6⁺ excess.
V6⁺ lact P-
S

~~PI (W3236 V6⁺) 1 drop X W3133 on M lac. 10⁴ ml, 10⁷ ml, 10⁸ ml.~~
~~PI (W1366) X W3236 on D-O.~~
~~selected for milk experiment checked as negative with~~
~~B-0 units per assay.~~
~~10⁻³ ml in 10 ml.~~

- ✓ 5. 30 On M lac W3236 X W3159 V6
- ✓ 6. " W3236 V6⁺ X W3133
7. PI (W3236 V6) 1 drop X W3133 on M lac. 10⁴ ml, 10⁷ ml, 10⁸ ml
8. PI (W1366) X W3236 on D-O.
- A28 40 No growth.
- Matings 1-4 on M lac. 10⁴ ml.
- P29. Good growth of 1-4. Colonies streaked on M lac.
 Purified colonies on M lac from 5th to 1 ml per assay.
- repeat #7.

DATE:

1/31/57

REF:

Count	To be	M. Pac	3	4	5	6	7	8	9	10
	V6	18			V6S					
1	—				—					
2	8				17					
3	0				33					
4	28				2					
5 ¹⁰	3	7	5		10	23	24			
6	10	21			9	5				

P2 S track from D-0 To B-0.

P3. Pick from B-0 to primary.

P4 Cross-track against T6 - Slave

	Let r	+S	-r	-S
1	00	00	00	6
1	00	00	00	23
1	00	00	00	35
2	00	00	26	00
2	00	00	15	00
2	00	00	29	1
3 ³⁰	00	19	5	00
3	00	20	9	00
3	00	4	2	1
4	28	1	0	7

40

50

mapping loc, region

DATE:

REF:

Control: Pick single colonies from ^{MR} into penicillin. ~~spread on 1/2 plate~~
~~spread on 1/2 plate~~ spread on 1/2 plate & 1/2 plate. ~~Keep the plate~~
 Next day spread 1 drop ^{F-prototroph} on 1/2 plate, then respread 3/4
 plate with Hfr auxotroph. This gives control - reversion in
 F-prototroph. I include W3133 control in all mixtures, to
 determine reversion in Hfr auxotrophs, and Melan control.

1. W1946 X W3153 V_6^+ control 0, ca. 1000 colonies 13, 14, 18, 17, 11
 2. W1946 V_6^+ X W3153 control 0, ca. 1000 colonies 26, 15, 12
 3. W1946 X W3133 0
 4. W1946 V_6^+ X W3133 0
 5. W1946, W1946 V_6^+ X W3153 V_6^+ . ca. 50 on W3153, no reversion.
 Streak colonies twice on Blue, test on 5 lact + T6.
 Test ca. 40 colonies per cross.

6. W1946 X Y70 V_6^+ 200 (0 control) 21r, 8S 5/1r, 20S
 7. W1946 V_6^+ X Y70 200 (0 control) 12r, 18S 17r, 42S
 8. W3120 X W3153 V_6^+ 2000 (20 col. control) 20r, 10S 49r, 29S
 9. W3120 V_6^+ X W3153 2000 (20 col. control) 10r, 20S 20r, 52S
 10. Test W1946 on W3133 10
 11. Test W1946 V_6^+ 5
 12. Test W3120 3
 13. Test W3120 V_6^+ 12

P18 14. W1946 X W3089 V_6^+ 2000, 0 40r, 10
 15. W1946 V_6^+ X W3089 2000, 0 30, 5/12
 16. W3221 X W3153 V_6^+ 2000, 0 17r, 30S
 17. W3221 V_6^+ X W3153 2000, 17 7r, 40 20r, 130
 18. W1946 0 27/17
 19. W1946 V_6^+ } 3133
 20. W3221 V_6^+ } 3133 } 38 very small

A \ B	3120	3221	1941	1945	1946	1949	3146	3127	3112
3120		-	-	-	-	-	-	+	+
3221			+	+	+	+	+	-	-
1941									
1945									
1946									
1949									
3146									
3127									
3112									

$\tau/\alpha > 1$

$v/\alpha < 1$

loc point increase

+
+
+
- = ABV
+
+ - + = BA ✓

Am x Ba
Ae x Be
Bex Am

DATE:

3/12/57

.05m react per unit M lac

REF:

Hfr	F ⁻	2	F ⁺ Int	F ⁻ Hfr recom.	n ⁵	n ⁶	7	8	9	10
W3221	3112V6	1	0	2000	24	19	repeat	✓		
W3221V6	3112	2	0	2000	31	16		✓		
W3221	3127V6	3	4	2000	15	30		✓		
W3221V6	3127	4	16	2000	25	11		✓		
W3221	3154V6	5	3	1500	21	29	} repeat			
W3221V6	3156	6	5	1500	22	28				
-	3152V6	7	4	2000	20	31	}			
- V6	3152	8	2	1500	26	22				
-	3148V6	9	0	2000	25	23				
- V6	3148	10	0	1500	47	0				
-	3153V6	11	8	2000	13	36	✓			
- V6	3153	12	17	2000	30	17	✓			
-	3133	} 13	0,0							
V6	3133									

3/23. allelic test of lac stocks.

F-V6 ⁺		F-V6 ^S		W3133
Hfr V6 ⁺	Hfr V6 ^S	Hfr V6 ⁺	Hfr V6 ^S	

3120 15 15 15 15 15

3221 50 50 50 50 50

1941 10 10 10 10 10

1945⁴⁰ 10 10 10 10 10~~1946~~

1949 20 20 20 20 3

3146 1000 (small) 1000 (small) 1000 (small)

1940 0 0 0 0 2000

a few lac⁺ from W3134.

may small reversion from W3089

(ca. 30)
many but reversion is F⁻
revert to 3146.

3/26/57

REF:

	1	2	#	control	readings	5	13	8	9	10
W3120	<u>V6</u>	W3089	1	0	1500					
		" V6	2	0	1500	49	2			
	<u>V6</u>	3148	3	12	1000	25	26			
		" V6	4	0	1000	30	19	✓		
	<u>V6</u>	3152	5	2	1500	22	28			
		" V6	6	5	1500	32	18	✓		
10	<u>V6</u>	3153	7	14	2000	17	33			
		" V6	8	12	1500	30	19	✓		
	<u>V6</u>	3156	9	9	2000	20	30			
		" V6	10	7	1500	26	24	✓		
	<u>V6</u>	3146 V6 ^S	11	0	2000	18	33			
		3175	12	0	2000	36	14	✓		
20	<u>V6</u>	3127	13	15	2000	34	14			
		" V6	14	3	1500	24	26	✓		
	<u>V6</u>	3112	15	0	1500	39	10			
		" V6	16	0	2000	12	38	✓		
	<u>V6</u>	3133	17	3,5	—					
	<u>V6</u>	3147	18	0	2000	9	41			
		" V6	19	0	2000					
30										
20			V6 ^r Tests			on Blac.				
			V6 ^r			V6 ^r				
	3120	—	—	22	S	—				
	3221	S	π	F	S	π				
	1941	S	π		S	π				
40	1945	S	π		S	π				
	1946				S	π				
21	1949	S	π	23	S	π				
	3146	—	π		S	π				
	3127	—	—		S	π				
50	3112	—	—		S	π				
	1940	S	π		S	π				
					(S)	← N.B.				

DATE:

REF:

	1	2	3	4 control	5 recipients	6	7	8	9	10
W3221	V6	3148	20	0	700	22	27	✓		
	" V6	" V6	21	✓ 2	2000	29	20			
	V6	3152	22	✓ 3	1000	30	19	✓		
	" V6	" V6	23	✓ 3	2000	19	31			
	V6	3153	24	✓ 1	2000	29	21	✓		
	" V6	" V6	25	✓ 6	2000	16	32			
10	V6	3156	26	✓ 2	1000	30	20	✓		
	" V6	" V6	27	✓ 0	300	19	30			
	V6	3146 V6	28	✓ 0	2000	22	28	?		
	" V6	3175	29	✓ 0	200	12	35			
	V6	3127	30	✓ 12	2000	36	14			
	" V6	" V6	31	✓ 3	2000	15	33			
	V6	3112	32	✓ 0	2000	25	21	?		
	" V6	" V6	33	✓ 0	2000	22	23	?		
20	V6 } " V6 }	3133	34	0, 0						
	V6	3147	35	0	2000	23	25			
	V6	3134	36	10	2000	17	28			
4/2/57 into DO.										
30	V6	3089	2	control		22				
W1941	" V6	" V6	3	2000, 0	18	14				
	V6	3152	4	1500, 3	22	17				
	" V6	" V6	5	2, 1500	17	23				
	V6	3153	6	2000, 10	26	14				
	" V6	" V6	7	2000, 6	15	24				
40	V6	3146 V6	8	2000, 0	15	21				
	" V6	3125	9	2000, 3	28	21				
	V6	3127	10	2000, 12	23	10				
	" V6	" V6	11	2000, 0	15	31				
	V6	3112	12							
	" V6	" V6	13							
	V6	3133	14	0, 0						
50	V6	3147	15							
	V6	3134	16	2000, 1	14	26				
	" V6	" V6	17	2000, 20	31	19				

(not complete lysis) Repeat

(not complete lysis)

REF:

	1	2	3	4	5	6	7	8	9	10
1941	V6 —	3156 11 V6	18 19	2000, 3 2000, 0	23, 13, 7	17 27, 13	✓ ✓			
Tried streaking from M lac plate (after transfer from original M lac recombinant plate) — very difficult to reach. 210 good.										
1945 10	V6 —	3230 3230 V6	1 2			45 10	36 19			
	V6 —	3089 V6	3 4	repeat		28		?		
	V6 —	3148 V6	5 6							
20	V6 —	3152 V6	7 8	repeat						
	V6 —	3153 V6	9 10			34 24	24 20	✓ ?		
	V6 —	3156 V6	11 12			23 30	27 17	? ?	✓ ✓	
	V6 —	3146 V6 st 3175	13 14							
30	V6 —	3127 — V6	15 16			22	28			
	V6 —	3147 — V6	17 18			20 31	26 18			
W3221	V6 —	3230 — V6	19 20							
1941 40	V6 —	3230 — V6	21 22							
1945	V6 on 3133		23							
50										

map lac₁, lac₂, V₆.

DATE: 4/29/57

REF:

	1	2	3	4	5	6	7	8	9	10
	5 streak w3164, w1366, w3164 V ₆ ⁺ , and w112 on B-O for single colony isolation.									
5/1	Single colonies into passay									
5/2	1ml w3164 + 1ml w1366 into D-D									
10	1ml w3164 V ₆ ⁺ + 1ml w112 into D-O									
	spread on D-O. Pick single colony & streak on B-O. Purified colony into 1ml D-O. Spot on M lac. cross streak spot on B-O against T6.									
		—	w3229	w1940	w1946		V ₆			
	lac ₂	0	+	+	+					
	lac ₁	0	0	+	+					
20	lac ₁ , ₂	0	0	+	0?					
	lac ₁	+	+	+	+					
	Two few cells	0	0	0	0					
②	A 1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
B	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
C	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
D	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
E	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
F	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
G	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
H	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
I	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
J	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
K	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
L	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
M	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
N	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
O	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
P	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
Q	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
R	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
S	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
T	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
U	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
V	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
W	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
X	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
Y	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					
Z	1	—	—	—	—					
	2	—	—	—	—					
	3	—	—	—	—					
	4	—	—	—	—					
	5	—	—	—	—					

DATE:

6/27/57

REF:

24 hrs. broths of 5 colonies, picked from B-O.

Spread 1 drops/plate on B-lac. 10 sec. UV

7/1/57 lac⁻ picked & streaked on B-lac.

7-3/57 streak on B gal

7-5¹⁰ pick into TSB

M lac

①

3133 Y10 30F9 3148 3156 3146F-Y⁺ 3153 3127

60-4 O + + + ++ # # #

60-3A O + + + ++ # # #

60-3B O + + + ++ # # #

60-3C O + + + ++ # # #

60-1A O + + + ++ # # #

60-1B O + + + ++ # # #

② 60-1C O # + # # # #

(63A)³⁰ O # # # # # #

63B # # # # # #

63C # # # # # #

63D # # # # # #

Lac⁻ stable from W3267

DATE:

6/29/57

REF:

1

2

3

4

5

6

7

8

9

10

1 drop W3267 2 hr. bro. on B lac. 10 sec. UV.
7/2/57 colonies all lac⁺. Lac⁻ (?) sectors streaked on B lac.

10

20

30

40

50

DATE: 7/2/57

REF:

reversion test of lac⁺ st
 w 3159 V6^r, w 3133 V6^r,
 streaked on B gal.

papillae / .05 ml.

3159

50

3133¹⁰

0

3269

0

3270

0

3271

0

3272²⁰

0

30

40

50

w 3269-72 F-X⁺V6^r

Inoculate V6, P, and W3229, W3269-72 65

DATE:

7/3/57

REF:

1. W3236 V6 X W3133 etc, on M lac. If heavy growth, no
inoculate with P. Dilute and plate on M lac. Pick and
count single colonies against V6.

2. W3236 X W3133 V6, etc.

.05 ml of each parent

10

on D lac

on M lac

1-1	W3236 R X	W3159	2-1	W3236 X W3159 V6 ⁺
1-2	"	3133	2-2	
1-3	"	3269 F-X ⁺	2-3	
1-4	"	3270 F-X ⁺	2-4	
1-5 ³⁰	"	3271 F-X ⁺	2-5	
1-6	"	3272 F-X ⁺	2-6	

7/5/57 dense recombination ∴ P and lac not absolutely linked.
sample 1/2 plate and streak on M lac.

	↑	↓
30		
1-1	0	20
1-2	0	20
1-3	1	18
1-4	0	36
1-5	7+4	16+13
40		
1-6	6	11
2-1	18	0
2-2		
2-3	2	11
2-4		
50		
2-5	17	0
2-6		

on M lac - remains that

70

DATE:

+3269F-X⁺

REF:

	1	2	3	4	5	6	7	8	9	10
+3153				+3153						
60-4	O			60-1C	+	195/	+			
60-3A	O			63A	O					
60-3B	3			63B	+++					
60-3C	5			63C	+++					
60-1A	++			63D	O					
60-1B	++			3267	+++					

63A

++

w3133

++

w346F-X⁺

+++

3127

63A

O

O

O

30 Purify lac⁺ colonies on B-O. Spent on B-O. Replicate on
(lost)
w3133, w3159, w3269-72F-X⁺ on M lac.

60-4 gal⁻

60-1A

63B

60-3A

60-1B

63C

60-3B

60-1C

63D

60-3C gal⁻

63A

50

Summary of N37

assuming

selection for Pool⁺

DATE:

REF:

assuming 2^e
Pool V₆ Lac V₁

Type	V ₆	Lac	Pool	V ₁	5	Exp ⁺ A	B	8	5	10
ace	s	+	+	r		8	8			bde
acd	s	+	+	s		5	10			b
a	s	+	-	c		46	21			a
ade	s	+	-	r		2	1			ade
abe	s	-	+	r		3	7			bce
abd	s	-	+	c		6	4			bcd
abc	s	-	-	c		5	1			acd
abcde	s	-	-	r		1	0			ace
bce	r	+	+	r		6	8			cde
bcd	r	+	+	c		2	9			c
b	r	+	-	c		9	4			abc
bde	r	+	-	r		1	0			abcde
e	r	-	+	r		57	71			e
d	r	-	+	c		47	75			d
c ₃₀	r	-	-	c		16	4			abd
cde	r	-	-	r		4	1			abc
						218	224			

Exper I.

8a	4 ab	(15)	4 bd	(10)	V ₆ -S
8b	4 ac	(19)	4 be	(14)	V ₅ -R
8c	4 ad	(14)	4 cd	(12)	Lac ⁺
8d ₄₀	4 ae	(14)	4 ce	(19)	Lac-
8e	4 bc	(14)	4 de	(8)	Pool ⁺

Exper A

Pool-
V₁-S
V₁-R

134
(61)
54
192
86
32

(46) a = $\frac{76}{218} = .349$ ✓

(9) b = $\frac{33}{218} = .151$ ✓

(47) d = $\frac{68}{218} = .312$ ✓

(16) c = $\frac{47}{218} = .216$ ✓

(57) e = $\frac{82}{218} = .376$ ✓

175

Summing of moments to 21,32,037

DATE:

REF:

Product formula

	1	2	3	4	5	6	7	8	9	10
	V_6		$Acc.$		$P_{-}L$		V_1		(TL)	
	(.349)	(.165)		.209		.220		(.394)	$\Sigma = 1.337$	
10	(-349)									
	(-362)									
	(-385)									
	(-608)									
20		.165								
		.245								
		.360								
		(-651)								
			.209							
30			.369							
			(.638)							
				.220						
				(.615)						
40								.394		
50										

$$E = -374 - .070 = -304$$

$$.594 - .176 = .418$$

$$.429 - .092 = .337$$

1000

1

2000-2001

3/23

16

12

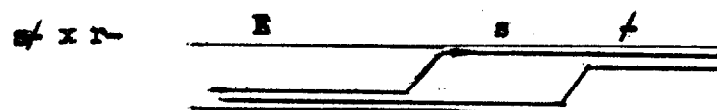
MAPPING THE LAC LOCI WITH W6 AS THE UNSELECTED MARKER

Prior information(J.L.) E gal Lp lac7 lac5 lac3 lac2 lac4 Y87 W112

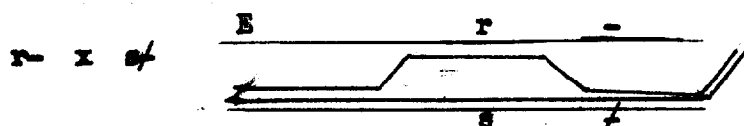
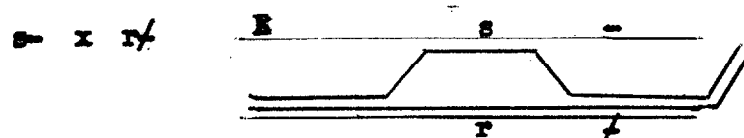
(W1366 x W3236) E W6 lac1 P
 35 15 22

I. lac⁺ x lac⁻; W3236 Hfr W6(^r_S) lac⁺ x F- W6(^s_r) lac⁻ on M lac or D lac.

r/s ~ 35/15



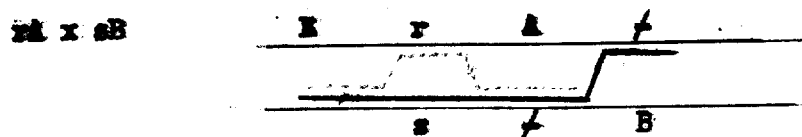
r/s ~ 15/35

II. lac⁻ x lac⁺; Hfr W6(^r_S) lac⁻ x Y10 F- W6(^s_r) TLB^r on M lac or D lac.r/s ~ $\frac{15 \times 35}{85 \times 65} = 5/55$ 

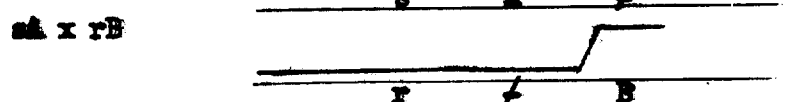
r/s ~ 55/5

III. lac A x lac B; Hfr W6(^r_S) lacA x F- W6(^s_r) lacB

Case 1. — E W6 A B

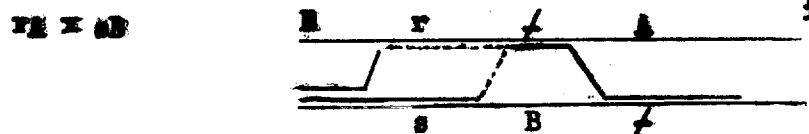


r/s < 1



r/s > 1

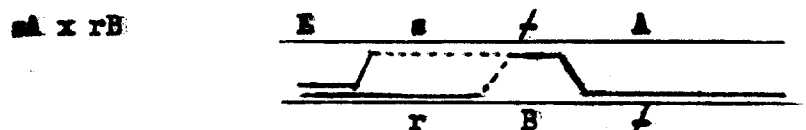
Case 2. — E W6 B A

negative
interference

r/s < 1

positive
interference

r/s > 1



r/s > 1

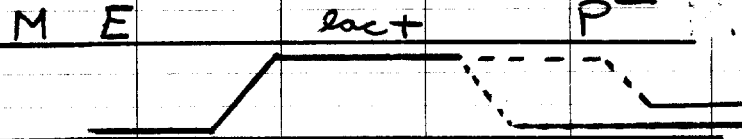
r/s < 1

mapping the lac loci with P^- as the selected marker

DATE:

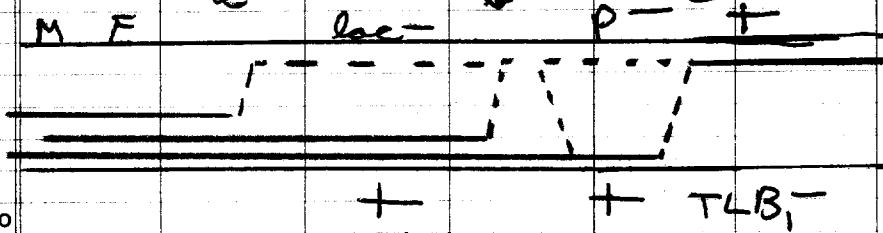
REF:

I. $lac^+ \times lac^-$; W3236 Hfr $V_6(\frac{+}{-}) lac^+ P^- \times F^- V_6(\frac{+}{-}) lac^-$
on D lac^+ + proline. Score for $P^+, -$.



$$P^-/+ > 1$$

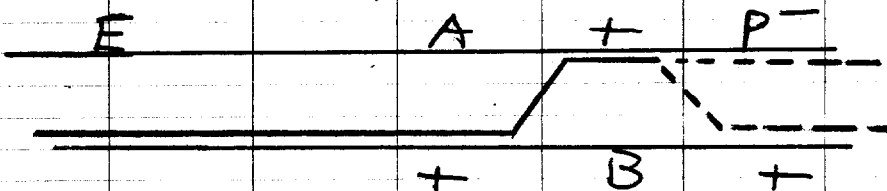
II. $lac^- \times lac^+$; Hfr $V_6(\frac{+}{-}) lac^- P^- \times Y10 F^- V_6(\frac{+}{-}) TLB_1^-$
on D - O + proline. Score for $P^+, -; lac^+/-$.



$lac^+ P^-$ b
 $lac^- P^+$ abc
 $lac^- P^-$ a
 $lac^+ P^+$ c

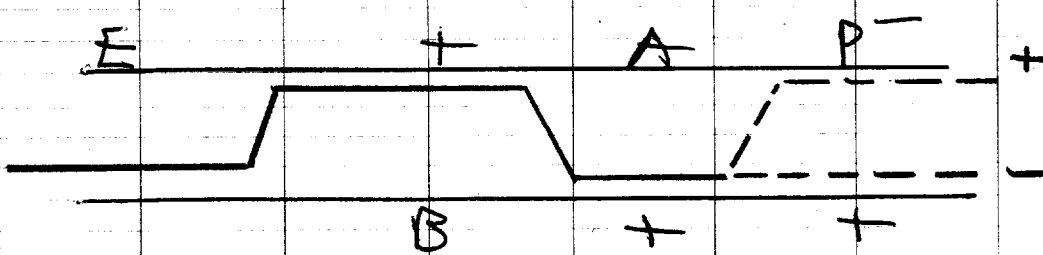
III. $lac A \times lac B$: Hfr $V_6(\frac{+}{-}) lac A P^- \times F^- V_6(\frac{+}{-}) lac B$

Case I. E A B P



on D lac^+ + proline.
neg. interference pos. interference
 $+/- > 1$ $+/- < 1$

Case II. E B A P

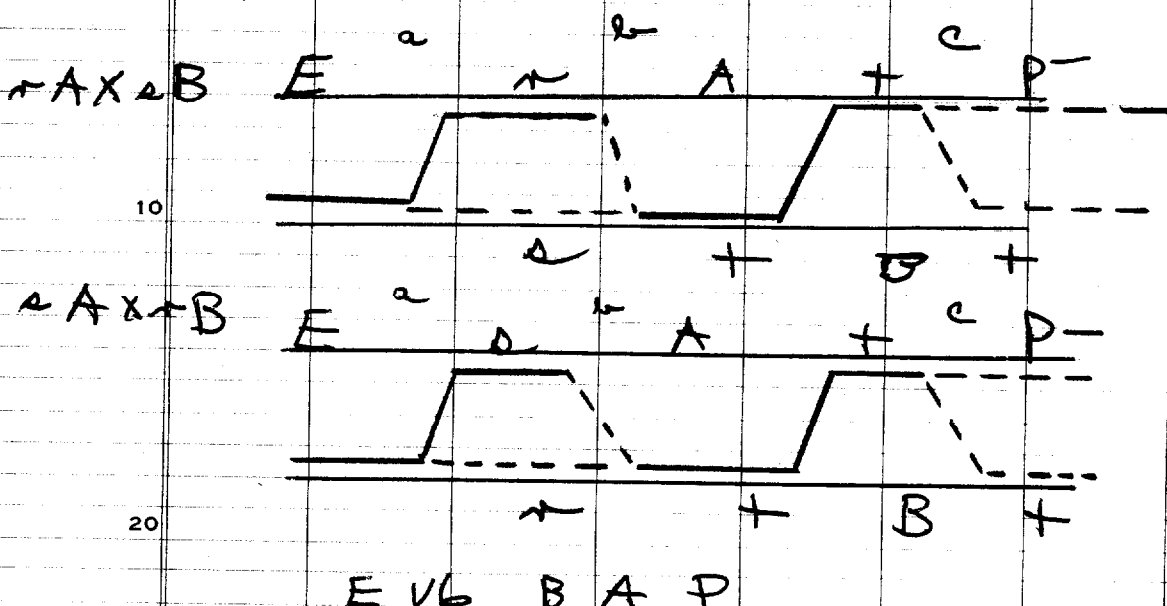


$$+/- < 1 \quad +/- > 1$$

mapping the loci with V6 and P as unselected markers

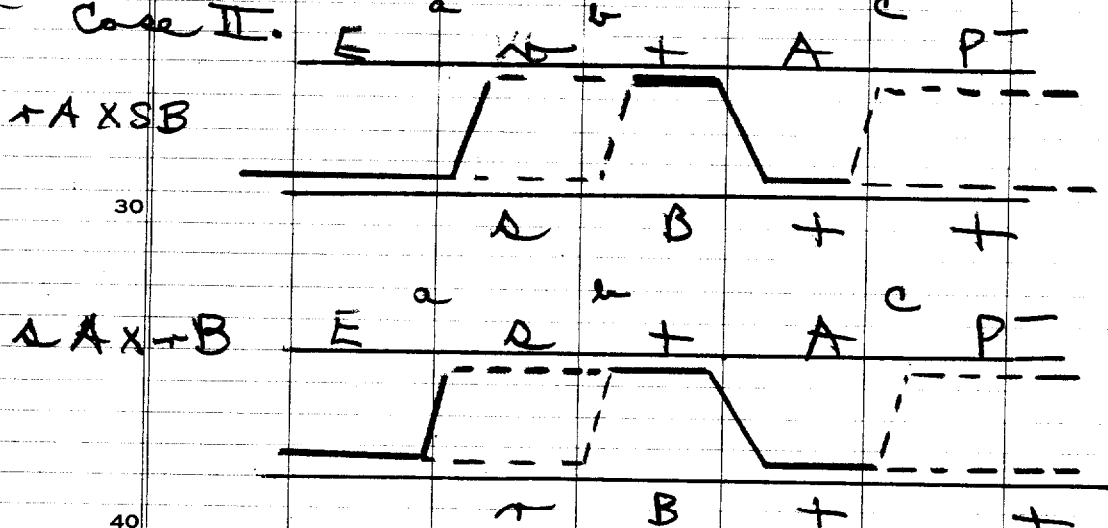
III. $\Delta \text{lac A} \times \text{lac B}$; Hfr $V6(\frac{2}{r}) \text{ lac A P}^- \times F_{\text{REV}}^- V6(\frac{2}{r}) \text{ lac B P}^+$
 on D lac^0 + protine.

Case I. EV6 AB P



V6	P	
r	-	a b
r	+	c
r	+	a b c
r	-	-
r	-	-
r	+	a b c
r	+	c
r	-	a b

Case II.



V6	P	
r	-	a b
r	+	b
r	+	c
r	-	c
r	-	c
r	+	c
r	+	c
r	-	c

Mapping Lac-1 Region

r/s

DATE:

REF:

A	B	2 Ar x Bs	4 As x Br 5	6 Br x As 7	8 Bs x Ar 9	Order
W3120	W3221	$\frac{17}{28} ?$	$\frac{48}{2} ?$	$\frac{7}{33} ? \frac{17}{28}$		
	W1941	$\frac{11}{32} \cdot \frac{18}{31} \cdot \frac{25}{26}$	$\frac{30}{19}$	$\frac{3134}{14} \frac{14}{26}$	$\frac{3134}{31} \frac{31}{19}$?
	W1945	$\frac{11}{35} \cdot \frac{18}{36} \cdot \frac{25}{28}$	$\frac{32}{18}$	$\frac{15}{36}$	$\frac{40}{10}$?
10	W1946	$\frac{30}{72} \cdot \frac{23}{50} \cdot \frac{13}{42} \cdot \frac{17}{33}$	$\frac{69}{39} \frac{30}{19}$			
	W1949	$\frac{17}{32} \cdot \frac{18}{37} \cdot \frac{20}{30}$	$\frac{26}{24}$			
	W3146	$\frac{21}{75} \cdot \frac{15}{45} \cdot \frac{18}{33}$	$\frac{36}{14}$			
20	W3127	$\frac{34}{14}$	$\frac{24}{26}$	—	—	ABV
	W3112	$\frac{39}{10}$	$\frac{12}{38}$			
W3221	W1941	$\frac{22}{27}$	$\frac{29}{20}$			
30	W1945	$\frac{30}{19}$	$\frac{19}{31}$	$\frac{28}{19}$?
	W1946	$\frac{27}{17} \cdot \frac{30}{17} \cdot \frac{29}{21}$	$\frac{17}{30} \cdot \frac{13}{36} \cdot \frac{16}{32}$	$\frac{30}{51} \cdot \frac{7}{40}$	$\frac{40}{1}$	ABV
	W1949	$\frac{30}{20}$	$\frac{19}{30}$	$\frac{24}{20}$		
	W3146	$\frac{22}{28} ?$	$\frac{12}{35}$	$\frac{7}{33} ?$		
40	W3127	$\frac{25}{11} \cdot \frac{36}{14}$	$\frac{15}{30} \cdot \frac{15}{33}$	—	—	ABV
	W3112	$\frac{31}{16} \cdot \frac{25}{21}$	$\frac{20}{22} \cdot \frac{21}{23}$			
W1941	W1945	$\frac{22}{17}$	$\frac{17}{23}$			
50	W1946	$\frac{26}{14}$	$\frac{15}{24}$	$\frac{9}{24}$	$\frac{23}{11}$	ABV
	W1949	$\frac{23}{17}$	$\frac{40}{20}$			

Mapping Lao-1 Region

r/s

DATE:

REF:

A	B	2 Ar x Bs 3	4 As x Br 5	6 Br x As 7	8 Bs x Ar 9	Order
W1941(cont.)	W3146	$\frac{15}{21}$	$\frac{28}{21}$	$\frac{3}{36} ?$		
	W3127	$\frac{13}{18}$	$\frac{15}{31}$			ABV
	W3112					
10 W1945	W1946		$\frac{24}{24}$	$\frac{10}{40} \checkmark \frac{8}{50}$	$\frac{36}{12}$	
	W1949	$\frac{24}{20}$				
	W3146	$\frac{23}{27}$	$\frac{30}{17}$	$\frac{19}{35} ?$		
20	W3127		$\frac{22}{28}$			
	W3112					
W1946	W1949	$\frac{18}{26} \checkmark \frac{10}{42}$	$\frac{26}{13}$			
	W3146	$\frac{9}{41}$				
30	W3127	$\frac{29}{19} \checkmark$	$\frac{17}{31} \checkmark$			ABV
	W3112	$\frac{33}{17} \checkmark$	$\frac{14}{36} \checkmark$			
	W3159	$\frac{27}{53}$	$\frac{42}{37} \checkmark$			BAV
40 W1949	W3146			$\frac{10}{47} ?$		
	W3127					
	W3112					
W3146 50	W3127	$\frac{27}{15} \checkmark$				
	W3112					